DOCUMENT RESUME

ED 207 525 IR 009 610

AUTHOR Dills, Charles R.; Bass, Ronald K.
TITLE [Microfiche/Audiotape and Teeth. An Experimental Trial of New Technology: The Second Year.]
SPONS AGENCY National Library of Medicine (DHEW), Bethesda, Md.
PUB DATE Apr 81
GRANT NLM-1G08LM03244-2/3
NOTE 23p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Audiotape Recordings; Comparative Analysis; *Cost Effectiveness; Dental Schools; *Independent Study; Intermode Differences; *Microfiche; *Slides
IDENTIFIERS *University of Florida

ABSTRACT

Two papers describe a 3-year project being conducted to evaluate the feasibility of replacing traditional slide-tape materials in a criterion-referenced, modularized, self-paced curriculum in dentistry with color microfiche and audiotapes. The experimental materials are being used with a microfiche-audiotape unit controlled by a microprocessor. Each frame of the microfiche is a copy of a 35mm slide which can be accessed randomly without disturbing the sequence of pictures, a feature which would permit the development of a random access branching, programmed learning system. Modules the dental student must study have been randomly divided into three groups for each of the years of the program: modules available only in slide-tapes, modules available only in microfiche-tape, and modules available in both formats. Students will have an approximately equal number of experiences with slides and with microfiche, except for the modules that are available in both, making the choice of format an indicator of the relative affective value of the two modes. Analysis of the final results will compare the management requirements and problems of both formats and their cost effectiveness, as well as student achievement and student attitudes toward the learning materials. Each paper lists 19 references. (CHC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED207525

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

MICROFICHE - AUDIOTAPE AND TEETH
AN EXPERIMENTAL TRIAL OF NEW TECHNOLOGY: THE SECOND YEAR

by

Charles R. Dills

and

Ronald K. Bass

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Ronald K. Bass

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

IR 009610

MICROFICHE - THEIR NEW ROLE IN MEDIA MANAGEMENT

By:

Charles R. Dills
Assistant in Dentistry
University of Florida

And

Ronald K. Bass
Associate Professor
Department of Dental Education
University of Florida

This project has been funded by the National Library of Medicine Grant #1G08LM03244-2

Introduction

Media management problems are becoming more and more complex with the increasing utilization and sophistication of educational delivery systems. One institution beset by these problems is the College of Dentistry of the University of Florida.

The curriculum in Dentistry at the University of Florida is a criterion-referenced, modularized, self-paced (both within and between modules) series of programmed learning experiences. These experiences are mediated through a variety of modes - workbooks, textbooks, video tapes, simulations, coloring books, small-group meetings, clinics, laboratories and slide-tape units. Some of the material is presented in duplicate through more than one modality.

As can be imagined, several management problems have arisen in this system. Some of these problems are associated with particular aspects of the system, while others are more pervasive in nature. Several of the more specific problems are associated with the presentations presented on slide-tape format, and this particular set of problems will be dealt with below.

Problem Statement

Several problems are associated with traditional self-instructional systems employing slide-tapes. First, the slide-tapes must be produced, and this is expensive. A slide tray must be purchased, slides must be produced and mounted, and a control tape made. But then the slides must be inserted into the tray, and this is a seperate step, which must be repeated for each duplicate slide-tape produced. Production of slide-tapes, both original and in duplicate, resists automation, and so is expensive in man-hours as well as in materials.

Once produced, the slide-tapes must be stored, and this is also expensive.

First, a storage room is required, and the square-foot cost of building library type facilities has been steadily increasing. Further, once the space is available, shelving of some sort must be installed, and this adds to the storage costs. Next, this space must be heated and cooled, lighted, cleaned, and all those other things done to media centers that are not covered in media management courses. These add considerably to the costs of maintaining a tape-slide library.

Stored tape-slides must be retrieved, and so personnel must be hired to retrieve these from the shelves. Further, to be retrieved, they must be cataloged in some manner, no matter how primative the system of cataloging, and this requires time from someone. And once used, the tape-slides must be re-shelved.

At the University of Florida and at similiar institutions, complications are added by the fact that students are self-paced. This means that the slide-tapes must be available over a wider range of hours on a greater number of days per year than in other types of systems, thus increasing all operating costs associated with the use of slide-tapes.

If slide-tapes are to be used, slide projectors and tape recorders must be available to the student upon demand over a large range of times. Maintenance of such equipment is expensive.

The presently available equipment is highly mechanical, and so wears out quickly under heavy use. A regular schedule of equipment replacement must therefore supplement the maintenance schedule.

Possible Solution

Recent advances in several areas of technology seem to suggest the solution of these problems lies through the use of micro-processors and of color micro-fiche. A Swiss-based company, Revox, had just developed a microfiche-audiotape unit controlled by a micro-processor, and this may be the solution to these problems.

The Revox microfiche-tape unit consists of a microfiche color viewer, a stereo tape deck, and a digitalized "encoder" or audio-tone generator.

A microfiche card is prepared, with a copy of a 35 mm color slide on each frame of the microfiche card. The microfiche is inserted into the viewer which together with the "encoder" may be used as a self-contained unit. The student, by pushing the tone controls on the encoder, can randomly access any frame on the microfiche.

The viewer can be used with the tape deck, however, much in the manner of the slide-tape set. The lecture is carried on one channel, and the audio-pulsed control signals are carried on the other channel. Unlike traditional slide-tape however, the audio control signals are not pulses. They are continuous audio tones, with a seperate frequency of tone for each frame, much as each number of a touch-tone telephone has an audio tone at a seperate frequency. Thus, frame #8, for example, is displayed any time its frequency tone is fed into the viewer. This means that the tape can be rewound, begun in the middle of the tape, backed up at any point, all without getting the pictures out of sequence. It thus can become, potentially, a random access branching, programmed learning system.

A grant has been obtained from the National Medical Library to field-test this system in the University of Florida College of Dentistry.

Design

The grant calls for the evaluation of a full-scale microfiche-tape installation over a three-year period.

The modules the dental student must study have been randomly divided into three groups for each of the years of the program: modules available only in slide-tape, modules available only in microfiche-tape, and modules available in both formats.

As the student moves through the program, he will have an approximately equal number of experiences with slides and with microfiche. Thus, when he

reaches a module in which he may choose either format, his choice becomes a significant indicator of the relative value of the two formats along the affective dimension.

The grant also calls for the evaluation of the cost-effectiveness of the two systems, slide and microfiche, over this three-year period. Primarily, cost-effectiveness will be defined as a function of maintenance costs, production and duplication costs, storage-retrieval costs, modular revision costs, and equipment acquisition costs. (Production costs include the costs of establishing and operating an in-house facility for the production of color microfiche).

Hypotheses

Fourteen hypotheses have been generated concerning the comparison of slide-tapes with microfiche-tapes. It is hypothesized that, at the end of the three-year period, it will be possible to report that:

1. Our students learn as well from microfiche-audiotape presentations as from slidetape presentations.
2. Our students reached competency in their various modules more quickly through use of the microfiche format than through the slidetape format.
3. Our students find the microfiche easy to use.
4. The availability of microfiche has affected a change in the study habits of our students.
5. Given the opportunity to utilize instructional materials in either the microfiche or the slidetape format, our students utilize materials in the microfiche format.
6. Given the opportunity to purchase instructional materials in either the micofiche format or the slidetape format, our students purchased materials in the microfiche format.
7. The storage space required of microfiche-audiotape materials is considerably less than the storage space requred for the storage of slidetape presentations.

8. The duplication cost for microfiche materials is considerably less than the duplication cost for slidetape materials.
9. Worn or missing materials can be replaced just as easily or more easily in the microfiche format as in the slidetape format.
10. The maintenance cost for microfiche-audiotape equipment is considerably less than maintenance cost for slidetape equipment.
11. When University of Florida College of Dentistry instructional materials are made available to other institutions in either the microfiche-audiotape format or the slidetape format, the other institutions order predominantly the microfiche format.
12. When University of Florida College of Dentistry instructional materials are made available to private practitioners in either the microfiche-audiotape format or the slidetape format, the practitioners order predominantly the microfiche format.
13. When University of Florida College of Dentistry instructional materials are made available for use in continuing education courses in either the microfiche-audiotape format or the slidetape format, the microfiche format is utilized just as often as the slidetape format.
14. As a result of the microfiche conversion project, microfiche utilization increased considerably in other Health Center college.

Preliminary Findings

To date the project has been primarily concerned with implementation and the gathering of base-line data. The University of Florida production facility is now fully operational, and the conversion of slide-tapes to microfiche-tapes has become more or less routine.

The student study center has been equipped with Revox viewers and tape decks, and several modules are now available for use.

Base-line data has been collected from a stratified sample of 1/3 of the dental students. We have found that:

1. Most students have had previous experience with traditional microfiche (over 90%) and for most (over 90%) it was not a pleasant experience.
2. Most students (over 75%) had high expectations from the new equipment.
3. These students had this expectation in spite of their lack of experience with it (100% of the interviewees had never heard of it before).
4. Most students have experienced difficulty with the use of slide-tapes (slides stick, synchronization fails) (over 80%).
5. Many students who enjoy learning verbally have discontinued the use of audio tapes and read accompanying scripts instead, because of the synchronization problem.

Over-all maintenance problems appear to be considerably less with the new equipment than with the slide-tape equipment, although we initially experienced considerable difficulty with tape-head alignment. We find that this is a critical factor in the Revox system, especially when using duplicated tapes.

Duplication costs are less for a microfiche-tape module than for a slide-tape module, and original production costs also appear to be less, but exact comparisons cannot yet be made, since large-scale duplication has not yet begun.

Future Developments

In addition to the basic study called for in the NML grant, plans exist extend the system in several ways. With new tape decks Revox is soon to put on the market, not only will the microfiche image be digitally coded, but so will each segment of the audiotape. Thus, not only will the system be a random access microfiche viewer, but also a random access audio unit.

Together with a new external programmable logic unit, the tape-microfiche will have acquired the same programming capabilities of PLATO, in that it

can go from any segment to any other segment, either in terms of previous programming or as a reaction to student response.

It should also be possible to improve learner control over pacing by incorporating variable speech control.

Furtner, by connecting an external microprocessor and memory device, such as an Apple or other similar microcomputer instantaneous records of student performance can be provided and micro-reinforcement can be given to the student while he is using the module. Later records of frame-by-frame student performance can be given to the faculty for use in formative evaluation of the student and for use in module redesign.

Thus it is expected eventually to have a system equivalent to large computer CAI in most important respects, but at a much lower per-terminal cost. Further, this system will be available upon demand to the student 24 hours a day, will not require a large operation staff, and can display full-colored visuals.

Only further studies of student response to the new units, and cost-benefit analysis of the total operation, will determine whether these developments are feasible. This data should be available within the next two years.

- -

This study has been funded by the National Library of Medicine Grant #1G08LM03244-01

BIBLIOGRAPHY

1. Acharia, Krishen M., "Impact of Color Microfiche on Medical Education, Research and Record", Journal of the Biological Photographic Association, 41 (2), April, 1973.

2. Butman, Robert C. and Frick, Fedrick C., "The Lincoln System: A Summary Report", M.I.T., 1972.

3. Campbell, B.W., "A Successful Microfiche Program", Special Libraries, 62 (3) , March, 1971.

4. Fiche, Elinore R., "A Study of Microfiche as an Alternative to the Reserve Room Function", Masters Thesis, Denver University, 1974.

5. Fothegill, R., "Microfiche in Educational Settings", Educational Media, 2,1976.

6. Fry,Carlton F., and Augskuger, Arol R., "Microfiche for Self-Study in Ocular Pathology", American Journal of Optometry and Physiological Optics, Volume 51 (6), June, 1974.

7. Grausnick, Robert and Kottenskette, James P., "Student Use of Classroom Microform in Support of a Survey Course", Colorado Research Institute, Denver University, 1971.

8. Hanson, L.E., "Color Microfiche Strengthens Veterinary Courses", Audiovisual Instruction, October, 1973.

9. Hurtgen, Thomas,"Microfiche in Dental Education", Dental Radiography and Photography, 48 (3), 1975.

10. Lewis, Ralph W., "Users Reaction to Microfiche: A Preliminary Study", College and Research Libraries, 31, July, 1970.

11. "Microfiche System Saves Time Cuts Shortage by 90 Percent", Modern Hospital 107 (2), August, 1966.

12. Morrison, Alta Bradley, "Microform Utilization: The Academic Library Enviornment", Denver University, 1971.

13. Palkuti, Gabriel A. and Wisnes, Beth L., "Microfiche as a Teaching Tool", Journal of the Biological Photographic Association 40 (1), January, 1972.

14. Pritchard, Alan "Microform Applications Within the City of London Polytechnic", City of London Polytechnic, 1973.

15. Renner, Will R. and Walters, Richard F., Color Microfiche as a Self-Instructional Medium", Journal of the Biological Photographic Association, 42 (1), January,1974.

16. Rizzo, William A. "Evaluation of Microfiche as an Instructional Meium in a Technical Training Enviornment", Naval Training Equipment Center, Orlando, Florida, 1977.

17. Rochlin, Phillip, "Micro Media in the Library: A Once Over Lightly", Journal of Micrographics, 6 (3), January 1973.

18. Smith, Chandler, "Microfiche for Teaching Pathological Anatomy", British Journal of Medical Education, 5:142-146, 1971

19. West, Martha W. and Butler, Butt B., Microreadings: Easing Obstacles to Library Distribution of Information", San Jose State University Library, March, 1974.

MICROFICHE - CAN THEY REPLACE SLIDES?

By:

Charles R. Dills
Assistant in Dentistry
University of Florida

And

Ronald K. Bass
Associate Professor
Department of Dental Education
University of Florida

This project has been funded by the National Library of Medicine Grant #1G08LM03244-3

INTRODUCTION

Can microfiche be used as a replacement for 35 mm slides as the primary medium for transmitting pictorial information in an educational setting? The second year of a three-year investigation designed to answer this question has just been completed at the University of Florida. No final, quantative answer is yet available, but a preliminary, qualitative answer based upon the first two years of the study seems to be "yes, providing..."

The present paper will elaborate upon this tentative "yes, provided...". The investigation and its setting will be described, tentative hypotheses will be discussed, and operational guidelines for successful use of microfiche will be listed. Finally, future probable developments in this field will be described.

SETTING

The curriculum in dentistry at the University of Florida is a criterion-referenced, modularized self-paced (both within and between modules) series of programmed learning experiences. These experiences are mediated through a variety of modes - workbooks, textbooks, video-tapes, simulations, small-group meetings, clinics, laboratories and slide-tape units. Some of the material, but not all, is presented through more than one modality. The sophistication of delivery systems varies greatly from module to module, from PLATO to coloring books.

The student body consists of four classes, each consisting of approximately 66 students. There are 13 deparmtnets, with a total of 112 full and part-time faculty lines.

Much of the mediated instruction occurs in the instructional materials

Center, which is located on the second floor of the Health Cneter Library Building.

Support is provided to the College of Dentistry by the Health Center Library, the Learning Resources Center and the Teaching Resources Center.

PROBLEM STATEMENT

As can be imagined, several management problems have arisen in this complex setting. Some of these are associated with specific aspects of the system, while others are more generally pervasive in nature. Several of the more specific problems are associated with the use of the slide-tape format within the self-instructional system.

The production of slide-tape is expensive. both in terms of money and in terms of time. First the slides must be photographed and mounted, and the narration/control audiotape must be prepared. Then a slide tray must be purchased and the slides must be loaded into the tray (this is a process which must be repeated for each duplicate copy). The production of slide-tapes, both original and in duplicate, is all but impossible to automate.

Once produced the slide-tapes must be stored and distributed, both expensive processes. First, a storage room, including appropriate shelving is required, and heating, lighting, cooling, cleaning, etc. must be provided. (The ever-increasing costs of construction, electricity, and personnel make an estimation of these costs almost impossible.) Then personnel to calalog and distribute the materials (including reshelving) must be employed.

At the University of Florida and at similiar institutions, complications are added by the fact that students are self-paced. This means that the slide-tapes must be available over a wider range of hours on a greater number of days per year in other types of systems thus increasing all

costs associated with the use of slide-tapes.

If slide-tapes are to be used, slide projectors and tape recorders must be available to the student upon demand over a large range of times. Maintenance of such equipment is expensive.

The presently available equipment is highly mechanical, and so wears out quickly under heavy use. A regular schedule of equipment replacement must therefore supplement the maintenance schedule.

POSSIBLE SOLUTION

Recent advances in several areas of technology seem to suggest the solution of these problems lies through the use of micro-processors and of color microfiche. A Swiss-based company, Revox, had just developed a microfiche-audiotape unit controlled by a micro-processor, which may facilitate the solution to these problems.

The Revox microfiche-tape unit consists of a microfich color viewer, a stereo tape deck, and a digitalized "encoder" or audio-tone generator.

A microfiche card is prepared, with a copy of a 35 mm color slide on each frame of the microfiche card. The microfiche is inserted into the viewer which together with the "encoder" may be used as a self-contained unit. The student, by pushing the tone controls on the encoder, can randomly access any frame on the microfiche.

The viewer can be used with the tape deck, however, much in the manner of the slide-tape set. The lecture is carried on one channed, and the audio-pulsed control signals are carried on the other channel. Unlike traditional slide-tape however, the audio control signals are not pulses. They are continuous audio tones, with a seperate frequency of tone for each frame, much as each number of a touch-tone telephone has an audio tone at seperate frequency. Thus, frame #8, for example, is displayed anytime its frequency tone

is fed into the viewer. This means that the tape can be rewound, begun in the middle of the tape, backed up at any point, all without getting the pictures out of sequence. It thus can become, potentially, a random access branching, programmed learning system.

A grant has been obtained from the National Medical Library to field-test this system in the University of Florida College of Dentistry.

DESIGN

The grant calls for the evalution of a full-scale microfiche-tape installation over a three-year period.

The modules the dental student must study have, for each of the three years of the investigation, been randomly divided into three groups: modules available only in slide-tape, modules available only in microfiche-tape, and modules available in both formats.

As the student moves through the program, he will have an approximately equal number of experiences with slides and with microfiche. Thus, when he reaches a module in which he may choose either format, his choice becomes a significant indicator of the relative value of the two formats along the affective dimension.

The grant also calls for the evaluation of the cost-effectiveness of the two systems, slide and microfiche, over this three-year period. Primarily, cost-effectiveness will be defined as as function of maintenance costs, production and duplication costs, stroage-retrieval costs, modular revision costs, and equipment acquisition costs. (Production costs include the costs of establishing and operating an in-house facility for the production of color microfiche).

PRELIMINARY FINDINGS: BASE-LINE DATA

Base-line data has been collected from 90% of the students in the College of Dentistry. This data records their attitudes toward, and previous experience with, microfiche and 35 mm slide systems. It also records their basic learning mode preferences. As these students graduate, similiar data is collected, so that comparisons may be made.

Preliminary analysis of this data show that:

1. Most students have had previous experience with microfiche (over 90%) and that, for most of these students (over 90%) this experience was not pleasant.
2. Most students (over 75%) had high expectations from the new equipment, in spite of their previous experiences.
3. These students had these expectations in spite of a lack of experience with the Revox equipment or any similiar system (100% had never heard of the system.
4. Most students have experienced difficulty with the use of slide-tapes while in the College of Dnetistry (over 80%; most frequently cited were: failure to advance, failure of synchronization, missing slides, sticking slides).
5. Many students modify their learning mode preference while in dental school, partially because of the problems experienced with slide-tapes. They cease listening to audio-tapes, and instead read scripts while advancing slides manually.

PRELIMINARY FINDINGS: MANAGEMENT OF THE SYSTEM

Large-scale conversion from slide-tapes, even when no content change is involved, cannot be successful unless accompanied by a continual monitoring of all aspects of the system. such a monitoring process has been a continuous aspect of the Florida project.

This monitoring of the total system has resulted in a continual development of the microfiche system. Although many problems were anticipated at the beginning of the project, student feedback has periodically resulted in modifications to procedures and environments involving microfiche.

For example, becuase of student feedback, the study carrels in the IMC have been modified. Originally, it was assumed that the same carrels could be used for both slide units and microfiche units. Student feedback showed a need for larger carrels for use with microfiche.

Student feedback has also resulted in other changes; the auxiliary equipment, such as encoders and earphones, associated with the microfiche units was originally stored in the library; they are now attached to the point of use, at the microfiche unit. This change is a direct result of student feedback.

Other monitoring functions have proved useful in discovering and eliminating problems in the conversion process at Florida. On several occasions faculty members have expressed fears directed toward the microfiche system, and, thanks to early discovery through the monitoring of faculty attitudes, these fears have been dealt with before they could harden into unfavorable attitudes. Continual monitoring of photographic quality within

the conversion process has proven essential to success.

While critical to the successful conversion from a familiar medium to an unfamiliar one, such a monitoring process is not sufficient in itself. Other management factors which must be exercised in conjunction with the monitoring process are a flexible budget, adequate personnel for conducting interventions, and a centralized operational control for the total conversion project, including the right of rejection for photographic products.

PRELIMINARY FINDINGS: SOFTWARE MANAGEMENT

Predicted advantages of the microfiche over 35 mm slides have been verified, but with qualifications. Microfiche are stored in vinyl folders together with scripts and audio tapes. These do indeed require less storage space than equivelant slide-tape units; but the savings is less than had been expected, becuase the binders used with the microfiche are larger than necessary.

As the industry develops, it is expected that a greater variety in microfiche storage units will become available, and with this, the savings in storage space obtainable by using microfiche rather than 35 mm slides should increase.

Savings in maintenance operations resulting from the absence of such problems as upside down or backward slides, spilled slide trays, slides in the wrong order, damaged slide mounts and missing individual slides has proven significant. However, the microfiche brought a new set of maintenance problems.

Microfiche are slippery, and fall out of their binders while being carried, and are easily lost. This problem has been easily dealt with, however, thorough the installation of special mountings for the microfiche within their binders. And replacement costs for missing microfiche is small. The

main problem involves scratches across the emulsion of the microfiche. Several protective coatings were investigated, but more were found to be adequate and cost effective. Again, replacement cost is low; this is only true, however, of in-house operations such as that at the University of Florida. Whether or not this solution remains practical when outside processing and printing of the microfiche is involved has not been determined.

In spite of these problems, the microfiche pose fewer problems for the library staff than do the conventional slide-tapes they are replacing. This is true in terms of storage space requirements, maintenance of material within storage units, and replacement.

PRELIMINARY FINDINGS: GENERAL

Can microfiche successfully replace 35 mm slides as the medium used to convey pictorial information to students in a self-instructional setting?

The preliminary answer to this question is "yes". Preliminary data indicate that:

1. Microfiche can be produced in-house from 35 mm slides in such a way that the images produced from the slides and the microfiche are educationally equivelent.
2. Student affect for the use of microfiche can be high.
3. Faculty affect for the use of microfiche can be high.
4. Predicted advantages to the library stemming from a change-over to microfiche-tape units from 35 mm slide-tapes are realizable.
5. Predicted cost-benifits due to in-house production of multiple copies of microfiche are realizable.

In order for the above conclusions to hold, a strong effort must be directed toward assisting the faculty and the students to adjust to the use of the new medium. Further, enough flexability must exist throughout the total environment.

Only further studies of student response to the new units, and cost-benefit analysis of the total operation, will determine whether these developments are feasible. This data should be available within the next two years.

This study has been funded by the National Library of Midicine Grant #1G08LM03244-3

BIBLIOGRAPHY

1. Acharia, Krishen M., "Impact on Color Microfiche on Medical Education, Research and Record", Journal of the Biological Photographic Association, 41 (2), April, 1973.

2. Butman, Robert C. and Rick, Fedrick C., "The Lincoln Training System: A Summary Report", M.I.T., 1972.

3. Campbell, B.W., "A Successful Microfiche Program", Special Libraries, 62 (3), March, 1971.

4. Ficke, Elinore R., "A Study of Microfiche as an Alternative to the Reserve Room Function", Masters Thesis, Denver University, 1974.

5. Fothegill, R., "Microfiche in Educational Settings", Educational Media 2, 1976.

6. Fry, Carlton F., and Augskuger, Arol R., "Microfiche for Self-Study in Ocular Pathology", American Journal of Optometry and Physiological Optics, Volume 51 (6), June, 1974.

7. Grausnick, Robert and Kotterskette, James P., "Student Use of Classroom Microform in Support of A Survey Course", Colorado Research Institute, Denver University, 1971.

8. Hanson, L. E., "Color Microfiche Strengthens Veterinary Courses", Audio-visual Instruction, October, 1973.

9. Hurtgen, Thomas, "Microfiche in Dental Education", Dental Radiography and Photography, 48 (3), 1975.

10. Lewis, Ralph W., "Users Reaction to Microfiche: A Preliminary Study", College and Research Libraries, 31, July, 1970.

11. "Microfiche System Saves Time Cuts Storage by 90 Percent", Modern Hospital 107 (2), August, 1966.

12. Morrison, Alta Bradley, "microform Utilization: The Academic Library Environment", Denver University, 1971.

13. Palkuti, Gabriel A. and Wisnes, Beth L., "Microfiche as a Teaching Tool", Journal of the Biological Photographic Associaton 40 (1), January, 1972.

14. Pritchard, Alan "microform Applications Witnin the City of London Polytechnic", City of London Polytechnic, 1973.

15. Renner, Will E., and Walters, Richard F., "Color Microfiche as a Self-Instructional Medium", Journal of the Biological Photographic Association,

16. Rizzo, William A. "Evaluation of Microfiche as an Instructional Medium in a Technical Training Environment", Naval Training Equipment Center, Orlando, Florida, 1977.

17. Rochlin, Phillip, "Micro Media in the Library: A Once Over Lightly", Journal of Micrographics, 6 (3), January, 1973.

18. Smith, Chandler, "Microfiche for Teaching Pathological Anatomy", British Journal of Medical Education, 5:142-146, 1971.

19. West, Martha W. and Butler, Butt B., "Microreadings: Easing Obstacles to Library Distribution of Information", San Jose State University Library, March, 1974.